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(12) United States Patent Pena et al.

(54) TUNNEL FIRE PROTECTION SYSTEM

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(56) References Cited

U.S. PATENT DOCUMENTS

5,409,066 A 4/1995 McHugh 6,158,519 A * 12/2000 Kretschmer A62C 35/645 169/16

(Continued)

FOREIGN PATENT DOCUMENTS

WO WO2007/118499 10/2007 WO WO 2013/106244 7/2013

OTHER PUBLICATIONS

International Search Report and Written Opinion, PCT/US2014/042473, dated Oct. 14, 2014.

(Continued)

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(57) ABSTRACT

A deluge fire protection system for tunnels having vehicle traffic including a main water supply pipe and a horizontal spray nozzle arrangement. The horizontal spray nozzle arrangement includes a nozzle device having an inlet portion defining an internal diameter and an external nominal diameter. The horizontal spray arrangement includes a coupling arrangement between the main water supply and the nozzle device. The coupling arrangement defines a multi-direction flow path between the main water supply and the nozzle device. The multi-direction flow path has an effective length of at least eight times a diameter of the inlet portion, and a cross-sectional area along the effective length greater than the cross-sectional area defined by a diameter of the inlet portion of the body of the nozzle device. The coupling arrangement provides for water delivery to the nozzle device (Continued)

